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MONITORING OF POPULATION DYNAMICS OF BLACK APHID, *TOXOPTERA AURANTII* INFESTING COCOA, *THEOBROMA CACAO* L. USING STICKY LIGHT TRAPS IN TAMIL NADU

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ABSTRACT

Field experiment was conducted in the farmer's holding at Sethumadai, Pollachi for a period of 7 months from October, 2014 to April, 2015 to monitor the population dynamics of black aphid, Toxoptera aurantii by installing coloured sticky light traps. Results revealed that the maximum number of aphids was trapped on yellow sticky light trap with the mean trap catches of 15.21 aphids per trap per week followed by 12.71 aphids per trap per week in blue sticky light trap. The mean trap catches of 9.93 and 7.78 aphids per trap per week were recorded in green and white sticky light traps, respectively. Red sticky light traps recorded the lowest mean trap catches of 5.52 per trap per week. In yellow and blue sticky light traps, the maximum trap catches of 22.25 and 16.75 aphids per trap were observed during fortieth and fifteenth standard weeks respectively, followed by 21.00 and 16.50 aphids per trap during fifty first and fortieth standard weeks, respectively. The trap catches were recorded to be the lowest during first standard week, irrespective of the colours. Aphids were more responsive towards yellow and blue colours compared to green, white and red. Yellow sticky light traps can be used for development of integrated pest management module as one of component for attraction and mass trapping of T. aurantii in cocoa plantations

KEYWORDS: Population Dynamics, Toxoptera aurantii, Sticky Light Traps, Cocoa, Tamil Nadu

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INTRODUCTION

Cocoa (*Theobroma cacao* L.) is one of the greatest treasurers ever discovered by man. It is the only source of chocolate and is a rich source of sensory pleasure and energy, adored by almost everyone. It is the third important beverage crop next to coffee and tea, and is third highest traded commodity in the world. It is one of the world's most valuable crops playing an important role in socio economic life of more than 5 million households and affecting 25 million in poor rural areas. Cocoa is cultivated worldwide over an area of 8.2 million hectares in fifty eight nations and the top five producers account for over 70 per cent of the total production (Prasannakumari *et al.*, 2012). Globally 43.55 lakh metric tonnes of cocoa has been produced during 2014. Ivory Coast, Ghana and Indonesia are the largest cocoa producing countries with the share of 34, 24 and 14 per cent of the world total production, respectively (ICO, 2014). In India, cocoa cultivation is largely confined to southern states *viz*., Kerala, Karnataka, Tamil Nadu and Andhra Pradesh. Cocoa is usually planted as inter crop in coconut and arecanut plantations. India ranks eighteenth among the countries cultivating cocoa having an area of 71,000 hectares with a production of 15,000 metric tonnes and productivity of 0.2 metric tonnes, of which Tamil Nadu covers an area of

24,000 hectares with a production of 1,100 metric tonnes. Kerala is leading in the production with a share of 41.72 per cent followed by Andhra Pradesh (37.08 per cent), Karnataka (13.90 per cent) and Tamil Nadu (7.28 per cent) (Indian Horticulture Database, 2014). Seasonal variation in abundance of tropical insects is a common phenomenon (Wolda, 1988; Pinheiro *et al*., 2002). Insect abundance can change over time for a variety of reasons, including macroclimatic and microclimatic changes and variation in the availability of food resources (Wolda, 1988). The effect of climate change contributing to extreme weather events like amount of rainfall, proliferation of pests, crop diseases and high temperature effects (NEST, 2004). Insects are able to function faster and more efficiently at higher temperatures. They can feed, develop, reproduce and disperse when the climate is warm, though they may live for a shorter time (Drake, 1994).

Determination of colour preference of crop pests may help to develop traps using attractive colours and provide opportunities for pest control by integrating specific colours into crop management methods. It helps either to reduce or avoid the use of synthetic pesticides and thereby helping to avoid the build up of pesticide residues in the environment and food (Leelanada *et al.*, 2007). With this background the present investigation on monitoring of population dynamics of *T. aurantii* was undertaken.

MATERIAL AND METHODS

Field experiment was conducted in the farmer's holding at Sethumadai, Pollachi for a period of 7 months from October, 2014 to April, 2015 to monitor the population dynamics of black aphid, *T. aurantii* by installing coloured sticky light traps. Light source to the coloured traps was provided using 15 W bulbs. The traps were smeared with white grease and castor oil in 50:50 ratio and tied to the branches at five feet height from ground level. The bulbs were run for 1 hour daily between 6.30 pm to 7.30 pm (Figure 1). The experiment was laid out in a randomized block design with the following five treatments and four replications in an area of 10,000 m^2.

Treatments

T_1: Yellow sticky light trap

T_2: Blue sticky light trap

T_3: Green sticky light trap

T_4: White sticky light trap

T_5: Red sticky light trap

Regular agronomic practices were followed as per Tamil Nadu Agricultural University Horticulture Crop Production Guide. Aphids attracted to the coloured sticky light traps and adhered to the sticky material were recorded at weekly intervals. Observations were made on the number of aphids trapped per week per trap from 1st week of October, 2014 to last week of April, 2015.

The data obtained from the field experiment were analyzed using AGRES ver. (7.01), Pascal International Solutions. The data were transformed to square root values and subjected to randomized block design (RBD) and mean values were separated by LSD (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Aphids trapped on the coloured sticky light traps installed in the farmer's field at Sethumadai were monitored for a period of 7 months at weekly intervals. Results revealed that the maximum number of aphids was trapped on yellow sticky light trap with the mean trap catches of 15.21 aphids per trap per week followed by 12.71 aphids per trap per week in blue sticky light trap. The mean trap catches of 9.93 and 7.78 aphids per trap per week were recorded in green and white sticky light traps, respectively. Red sticky light traps recorded the lowest mean trap catches of 5.52 per trap per week (Table 1).

In yellow and blue sticky light traps, the maximum trap catches of 22.25 and 16.75 aphids per trap were observed during fortieth and fifteenth standard weeks, respectively followed by 21.00 and 16.50 aphids per trap during fifty first and fortieth standard weeks, respectively. The trap catches were recorded to be the lowest during first standard week, irrespective of the colours (Table.1). From the results, it inferred that aphids were more responsive towards yellow and blue colours compared to green, white and red. These results are in line with the findings of Gopikrishna (2014) who reported attraction of aphids towards yellow sticky traps in cocoa plantations. Straw *et al.* (2011) also reported that the highest number of alate aphids, *Elatobium abietinum* were caught on yellow, red and green sticky traps than on white, blue and black traps in order of preference. Conclusion made from the investigation that yellow sticky light traps can be used for development of integrated pest management module as one of the component for attraction and mass trapping of *T. aurantii* in cocoa plantations.

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APPENDICES

Table 1: Monitoring of Population Dynamics of Black Aphid, *Toxoptera aurantii* using Sticky Light Traps during 2014-2015

Date/ Month	Std. Week	Number of Insects Trapped Per Week*						
		T_1- YSLT	T_2 - BSLT	T_3- GSLT	T_4 - WSLT	T_5 - RSLT	S. Ed	CD
01 to 07 October	40	22.25^{a} (4.77)	16.50^{b} (4.12)	12.75^{c} (3.64)	8.75^{d} (3.04)	5.75^{d} (2.50)	1.57	3.41
08 to 14 October	41	19.50^{a} (4.47)	14.50^{b} (3.87)	9.50^{c} (3.16)	6.25^{d} (2.60)	4.00^{e} (2.12)	0.92	2.00
15 to 21 October	42	20.25^{a} (4.55)	16.50^{b} (4.12)	12.50^{c} (3.60)	11.50^{c}(3.46)	4.25^{d} (2.18)	1.31	2.87
22 to 28 October	43	17.50^{a} (4.24)	15.75^{b} (4.03)	12.25^{c} (3.57)	7.25^{d} (2.78)	4.00^{e} (2.12)	0.70	1.50
29 to 04 November	44	15.75^{a} (4.03)	14.25^{a} (3.84)	12.50^{ab} (3.60)	7.75^{c} (2.87)	7.75^{c} (2.87)	1.13	2.47
05 to 11 November	45	11.00^{a} (3.39)	10.25^{a} (3.28)	7.75^{b} (2.87)	7.50^{b} (2.83)	3.50^{c} (2.00)	0.77	1.68
12 to 18 November	46	11.25^{a} (3.43)	9.25^{ab} (3.12)	8.25^{b} (2.96)	6.75^{c} (2.69)	4.25^{d} (2.18)	1.06	2.31
19 to 25 November	47	11.25^{ab} (3.43)	12.00^{a} (3.53)	9.25^{b} (3.12)	6.25^{c} (2.60)	4.50^{d} (2.24)	1.12	2.45
26 to 02 December	48	12.25^{a} (3.57)	9.50^{b} (3.16)	8.25^{bc} (2.96)	7.50^{bc} (2.83)	6.50^{c} (2.65)	1.25	2.71
03 to 09 December	49	16.75^{a} (4.15)	14.75^{a} (3.90)	11.00^{b} (3.39)	7.75^{c} (2.87)	6.50^{c} (2.65)	1.16	2.53
10 to 16 December	50	12.75^{a} (3.60)	11.00^{b} (3.39)	7.75^{c} (2.87)	7.00^{cd} (2.74)	5.50^{d} (2.45)	0.75	1.65
17 to 23 December	51	21.00^{a} (4.64)	14.00^{b} (3.81)	12.75^{b} (3.64)	8.25^{c} (2.96)	7.50^{c} (2.83)	1.63	3.54
24 to 31 December	52	16.75^{a} (4.15)	13.25^{ab}(3.71)	13.00^{ab} (3.67)	10.75^{bc} (3.35)	5.75^{c} (2.50)	1.84	4.00
01 to 07 January	01	12.50^{a} (3.60)	8.25^{b} (2.96)	6.75^{b} (2.69)	6.50^{b} (2.64)	0.75^{c} (1.11)	0.16	0.34

(Contd.,)

Date/ Month	Std. Week	Number of Insects Trapped Per Week*						
		T_1- YSLT	T_2 - BSLT	T_3- GSLT	T_4 - WSLT	T_5 - RSLT	S. Ed	CD
08 to 14 January	02	15.50^{a} (4.00)	12.00^{b} (3.53)	11.50^{c} (3.46)	9.75^{cd} (3.20)	7.50^{d} (2.83)	1.01	2.21
15 to 21 January	03	16.25^{a} (4.09)	12.50^{b} (3.60)	8.00^{c} (2.91)	5.75^{d} (2.50)	5.25^{d} (2.40)	0.97	2.11
22 to 28 January	04	13.25^{a} (3.70)	13.00^{a} (3.67)	8.00^{b} (2.91)	4.00^{c} (2.12)	5.50^{bc}(2.45)	1.27	2.77
29 to 04 February	05	15.00^{a} (3.94)	13.50^{a} (3.74)	7.50^{b} (2.83)	4.25^{c} (2.18)	0.75^{d} (1.12)	0.13	0.29
05 to 11 February	06	11.75^{a} (3.50)	9.75^{b} (3.20)	10.00^{b} (3.24)	7.25^{bc} (2.78)	7.50^{c} (2.83)	1.70	3.71
12 to 18 February	07	14.75^{a} (3.90)	13.50^{ab}(3.74)	10.00^{bc} (3.24)	7.25^{cd} (2.78)	5.75^{d} (2.50)	1.68	3.66
19 to 25 February	08	14.75^{a} (3.90)	12.50^{a} (3.60)	9.50^{b} (3.16)	8.00^{bc} (2.91)	6.75^{c} (2.69)	1.78	2.57
26 to 04 March	09	12.00^{a} (3.53)	10.50^{ab}(3.32)	8.75^{b} (3.04)	10.50^{ab} (3.32)	5.50^{c} (2.45)	1.10	2.32
05 to 11 March	10	17.00^{a} (4.18)	12.25^{b} (3.57)	8.50^{c} (3.00)	5.75^{d} (2.5)	7.50^{cd}(2.83)	1.05	2.30
12 to 18 March	11	15.75^{a} (4.03)	13.75^{a} (3.77)	9.50^{b} (3.12)	6.25^{c} (2.60)	3.50^{d} (2.00)	1.17	2.55
19 to 25 March	12	15.25^{a} (3.97)	14.00^{a} (3.80)	10.25^{b} (3.29)	7.75^{c} (2.87)	7.50^{c} (2.83)	1.10	2.34
26 to 01 April	13	14.00^{a} (3.80)	11.25^{b} (3.45)	10.75^{bc} (3.35)	9.00^{c} (3.08)	6.50^{d} (2.64)	0.92	2.00
02 to 08 April	14	14.00^{a} (3.80)	12.00^{b} (3.53)	8.50^{c} (3.00)	8.00^{c} (2.91)	6.75^{d} (2.69)	0.86	1.86
09 to 15 April	15	18.50^{a} (4.36)	16.75^{a} (4.15)	12.25^{b} (3.57)	9.50^{bc} (3.16)	7.50^{c} (2.83)	1.45	3.15
16 to 22 April	16	14.00^{a} (3.80)	11.75^{ab}(3.50)	11.00^{ab} (3.91)	8.00^{bc} (2.91)	5.25^{c} (2.34)	1.39	3.02
23 to 29 April	17	13.75^{a} (3.77)	12.50^{ab}(3.60)	11.50^{b} (3.46)	8.75^{c} (3.04)	6.00^{d} (2.55)	0.99	2.11
Mean	-	15.21	12.71	9.93	7.78	5.52	-	-

**Mean of four replications*

In a row, means followed by common alphabets are not significantly different by LSD (P=0.05)

Figures in parenthesis are square root transformed values

YSLT = Yellow Sticky Light Trap

BSLT = Blue Sticky Light Trap

GSLT = Green Sticky Light Trap

WSLT= White Sticky Light Trap

RSLT = Red Sticky Light Trap

Field View of Installed Traps

Yellow Sticky Light Trap

Blue Sticky Light Trap

Green Sticky Light Trap

White Sticky Light Trap

Red Sticky Light Trap

Figure 1: Monitoring of Population Dynamics of Black Aphid, *T. aurantii* using Sticky Light Traps